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APPLICATION FOR LETTERS PATENT OF THE UNITED STATES

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TITLE OF INVENTION: METHOD AND DEVICE FOR UTILIZATION OF
A STETHOSCOPE AS A NEUROLOGICAL DIAGNOSTIC TOOL AND
PERCUSSION TOOL

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METHOD AND DEVICE FOR UTILIZATION OF A STETHOSCOPE AS A NEUROLOGICAL DIAGNOSTIC TOOL AND PERCUSSION TOOL

CROSS-REFERENCE TO RELATED APPLICATIONS.

This application claims the benefit of United States Provisional Patent Application Ser. No.: 60/392,319, filed 27 June 2002, the contents of which are hereby incorporated by reference herein in their entirety.

FIELD OF THE INVENTION.

This invention relates to a medical diagnostic tool, and more specifically to a stethoscope capable of neurological diagnosis and percussion functions.

BACKGROUND OF THE INVENTION.

Reflex hammers, which have heretofore been in common use, have had a variety of functional limitations. For example most reflex hammers are heavy, bulky instruments that physicians have to carry with them. Storing reflex hammers in pockets causes discomfort due to the odd shape and needed weight for reflex testing. For example, a common hatchet-type reflex hammer is made with a hatchet-like head connected to a ridged shaft. This type of reflex hammer, as well as others with shafts does not permit easy portability. Additionally reflex hammers can be inadvertently lost, misplaced or not handy when needed when not carried in pockets or lab coats. While it is known that a large population of physicians have used standard stethoscopes, alone, for reflex tests without this device, they have had limited success, due to the flex of the hose tubing, and some discomfort to the patient who has been contacted because of the hardness and shape of the stethoscope head.

U.S Pat. No. 6,510,918 B2 (Bates) describes a combined stethoscope and reflex hammer, wherein the head of the reflex hammer is incorporated into an o-ring securing the diaphragm membrane of the stethoscope chest piece. A rigid handle is provided by a penholder rigidly affixed to the stethoscope in proximity to the chest piece. The reflex hammer of the present invention is attached to the stethoscope such that neither the diaphragm nor the bell of the stethoscope is affected by the reflex hammer.

1 European Patent No. 269,048 discloses a stethoscope modified to contain
2 several medical devices, including a reflex hammer, attached laterally to the
3 stethoscope head, a means for retaining a needle which commonly is used for
4 neurological testing, and a light source.

1 BRIEF SUMMARY OF THE INVENTION.

2

3 The present invention is intended to provide a reflex hammer, which avoids
4 the limitations, referred to above and further provide a hammer that is ideal for all
5 normal neurological reflex testing. In the present invention the reflex hammer
6 attaches to the distal end of a stethoscope. This has many advantages as it utilizes
7 the existing weight of the stethoscope head. It attaches to the stethoscope in a way that when
8 that does not impede the use of the stethoscope for normal pulmonary use. The
9 shape of the hammerhead is mated to the stethoscope head in such a way that when
10 combined the weight is equal to existing reflex hammers. Medical personnel can fold
11 the stethoscope into their pocket, and/or drape it around their neck with no
12 additional limitations.

13

14 Thus, one embodiment of the present invention is a tool for medical testing,
15 the tool comprising, in combination:

16 a stethoscope, the stethoscope comprising:

17 a stethoscope head, the stethoscope head having an operational
18 surface;

19 one or more earpieces; and

20 a means for connecting the stethoscope head with the earpiece;

21

22 a reflex hammer, the reflex hammer attached to the stethoscope head, the
23 reflex hammer comprising:

24

25 a body having a rim, a wall adjoining the rim, and an opening therein,
26 the stethoscope head being received in the opening, the rim being larger than
27 the stethoscope head, the body positioned on the stethoscope head such that
28 the reflex hammer does not interfere with the stethoscope head operational
29 surface; and

30 a handle, the handle joined to the body, the handle sized to receive and semi-rigidly
31 receiving the connecting means therein. Another embodiment of the present
32 invention is a method for employing a stethoscope as a neurological tool, comprising
33 the steps of:

34 affixing to a stethoscope, the stethoscope comprising a stethoscope
35 head having an operational surface;

1 one or more earpieces; and
2 a means for connecting the stethoscope head with the earpiece,
3 a reflex hammer, the reflex hammer comprising:
4 a body having a rim, a wall adjoining the rim, and an opening therein,
5 and the rim being larger than the stethoscope head;
6 receiving the stethoscope head in the opening;
7 positioning the body on the stethoscope head such that the reflex
8 hammer does not interfere with the stethoscope head operational surface;
9 and
10 attaching a handle to the connecting means, thereby semi-rigidly
11 receiving the connecting means therein.

12
13 Thus, the present invention comprises a tool for neurological and diagnostic
14 testing comprises the combination of a stethoscope with a reflex hammer. When
15 mounted on the stethoscope head the reflex hammer extends beyond the head,
16 without interfering with the normal use of the stethoscope. A handle, which may or
17 may not be joined to the reflex hammer, is positioned on the flexible stethoscope
18 tubing and provides a gripping surface for using the tool for neurological testing.
19 One embodiment has an opening between the reflex hammer body and the handle
20 enabling the user to grasp and rotate the stethoscope head. The reflex hammer,
21 which can be made from one or more members, is adaptable for use with binaural
22 and electronic stethoscopes. A detent on the handle provides an ergonomic grip, or
23 a place for inclusion of indicia. Additionally, the present invention can be used for
24 percussing body parts in need of percussion for purposes of diagnosis and treatment.

1 DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS.

2
3 The foregoing objects and advantages of the present invention will be more
4 clearly understood when considered with the accompanying drawings, in which:

- 5 Fig. 1 is a perspective view of a "standard", binaural stethoscope;
6 Fig. 2 is a close up view of a typical stethoscope head and tubing section;
7 Fig. 3 is a perspective view of an electronic stethoscope.
8 Fig. 4A is a perspective view of an embodiment of the present invention.
9 Fig. 4B is a perspective view of the embodiment of Fig. 4A attached to a
10 stethoscope, a LITTMAN® (registered trademark of 3M Company Corp., St. Paul,
11 MN) Classic II model stethoscope.
12 Fig. 5A is a cross-sectional view of the embodiment of Fig. 4A, taken along lines 5A—
13 5A of Fig. 4A, attached to the stethoscope shown in Fig. 4B.
14 Fig. 5B is a side view of the embodiment shown in Fig. 4B.
15 Fig. 6 is a perspective view of a reflex hammer in accordance with one embodiment
16 of the present invention, prior to being affixed to a stethoscope head;
17 Fig. 7 is a perspective view of the reflex hammer affixed to the stethoscope, in
18 accordance with an embodiment of the present invention;
19 Fig. 8 illustrates schematic views of a reflex hammer embodying the present
20 invention in actual usage when striking the knee of an individual;
21 Fig. 9A illustrates an adaptation in manufacturing, by increasing the length of the
22 stem going into the stethoscope head, in accordance with one embodiment of the
23 present invention;
24 Fig. 9B illustrates a locking mechanism on the stem, in accordance with an
25 embodiment of the present invention;
26 Fig. 10 shows a donut-shaped attachment element mounted on the head of the
27 stethoscope to increase the surface area of the reflex striking force, in accordance
28 with an embodiment of the present invention;
29 Fig. 11 shows an add-on stem that would allow a stethoscope head to function as a
30 reflex hammer, in accordance with an embodiment of the present invention;
31 Fig. 12 illustrates both the donut-shaped attachment element and the add-on stem,
32 attached to a stethoscope, in accordance with an embodiment of the present
33 invention;
34 Figs. 13 A and B illustrate an embodiment of the reflex hammer manufactured as a
35 two-piece clam shell that can snap together around a stethoscope head; and

1 Figs. 14 A and B illustrate another embodiment of the reflex hammer manufactured
2 as a two-piece asymmetrical clam shell that can be snapped together around the
3 stethoscope head.
4

1 DETAILED DESCRIPTION OF THE INVENTION.

2

3 The present invention is a medical device that can be used both as a
4 stethoscope for the monitoring of bodily sounds, and as a reflex hammer for
5 performing neurological testing and related functions.

6

7 Stethoscopes are well-known medical instruments, the "standard" (binaural)
8 variety (Figs. 1 and 2) being the most commonly known type. Stethoscopes enable
9 the user to listen to respiratory and cardiac sounds within the chest, and for
10 auscultation of the vascular or other sounds within the body. Newer, electronic
11 stethoscopes have been developed which are stated to improve the user's ability to
12 monitor these bodily sounds.

13

14 Referring to the binaural stethoscope shown in Fig. 1, stethoscope **1**
15 comprises a stethoscope head **3** having chest pieces **4** and **5**, (chest pieces), a
16 tubular stem **6** that extends from the stethoscope head **3** into a length of flexible
17 tubing **7** that bifurcates and leads to two ear pieces **8**, which are placed in the user's
18 ears in order to listen to the sounds picked up by the operational surfaces **4** and **5**.
19 Surrounding chest pieces **4** and **5**, along their outer edge, is a rim **9**, which is
20 generally manufactured from an elastomeric material, such as a rubber. The chest
21 pieces are connected to each other by means of a neck **10**, in communication with
22 stem **6**. By rotation of the stem **6**, a user can switch between using the bell **4** and
23 diaphragm **5**.

24

25 For purposes of this specification, the terms "bell" and "diaphragm" will be
26 used interchangeably with "chest pieces" and "operational surfaces" when referring
27 to reference numerals **4** and **5**, respectively.

28

29 Electronic stethoscopes generally resemble binaural ones, but the shapes of
30 the head and diaphragm differ from those of a binaural stethoscope. Referring to
31 Fig. 3, an electronic stethoscope **150** has a head **152** which includes a diaphragm
32 **154**. Head **154** is joined to tubing **158** by means of stem **156**, in which some of
33 the stethoscope electronics, such as volume controls, are contained. Module **160**,
34 mounted between lengths of tubing **158** and **162** also includes some of the
35 stethoscopes electronics, such as a battery and battery chamber. The second length

1 of tubing **162** bifurcates, and is joined to earpieces **166** by means of a connecting
2 rod **164**. Other types of stethoscopes are known that have greater than two
3 operational surfaces.

4

5 In accordance with one embodiment of the invention, a reflex hammer **20** is
6 to be affixed to a stethoscope head **3** and tube section **7** (Figs. 1, 4 and 5). One
7 embodiment of the reflex hammer **20** of the present invention is illustrated in Figs. 4
8 and 5.

9

10 The device **20** comprises a handle **22** that can be formed from of one or more
11 members, and a body **24** which engages the neck **10** between the chest pieces **4**
12 and **5** (Figs. 4 and 5). Handle **22** receives therein the stem **6** and a portion of the
13 stethoscope tubing **7** creating a tool that is suitable for reflex testing (shown in Fig.
14 8). The combination of the handle **22** surrounding a portion of the stethoscope
15 tubing **7**, and the receipt of the stem **6** within the handle, creates what is termed a
16 "semi-rigid" section, meaning that there is some flex to the combination, but much
17 less flex than would occur in the absence of the handle (i.e., with just the tubing
18 alone). The end **26** of the handle **22** can be used as a grip.

19

20 The body **24** comprises a rim **28** connecting a pair of walls **30**. In this
21 embodiment, body **24** is hollow, the opening **32** between the walls serving to receive
22 therein the head of a stethoscope (for example, Figs. 4B and 5A-5B). In the region
23 **34** that forms a junction between the body **24** and the handle **22** is an aperture **36**
24 into which the user can insert their fingers and rotate the stem **6** of the stethoscope.
25 In another embodiment of the present invention, the body can be solid, but still
26 retain the opening for receipt of the stethoscope head.

27

28 In this embodiment of the present invention, handle **22** includes a widened
29 region **38** and a detent **40** towards the end of the handle, i.e., most distant from the
30 body. This detent **40** can be formed on one or both sides of the handle **22** and, in
31 this embodiment, the detent is generally flat, allowing for ergonomic finger
32 placement and a comfortable grip.

33

34 Although not shown in the figures, the detents **40** may include other
35 elements to improve the user's comfort, such as one or more ridges, nibs, pads,

1 cushions, strips of tape, or similar elements known to those skilled in the art. The
2 configuration of the detents **40** is such that indicia, such as, but limited to, a
3 manufacturer's name, a logo, directions for use, advertising content, notations, or
4 the like, could be placed thereon, using methods known to those skilled in the art.

5

6 The reflex hammer body **24** has a diameter that is larger than the
7 stethoscope head **3** (see, for example, Figs. 4B and 5B) thereby allowing the reflex
8 hammer rim **28** to make contact with the larger surface area **53** of a patient (Fig. 8).
9 The device may be secured to a range of different stethoscope tube thicknesses and
10 head designs. A molded adapter may be provided to allow for the device to fit over
11 a range of different stethoscopes, in accordance with an embodiment of the present
12 invention.

13

14 The device may be slid over a portion of the tubular section **7** to form a
15 tactile grip. The tactile grip allows the stethoscope head section to be gripped and
16 used for various medical procedures. These procedures include, for example only
17 and not intended as a limitation, reflex testing, percussion of a chest wall, or other
18 bodily area in need of percussion for diagnostic purposes.

19

20 Fig. 4 illustrates a preferred method for attaching the reflex hammer **20** to a
21 typical stethoscope. To this end, handle **22** is suitably secured to the tube **7** in a
22 manner that allows the stethoscope dual head to rotate to its full 180 degrees to
23 allow both the bell **4** and diaphragm **5** to be used (Figs. 1, 5B).

24

25 Operation of the device.

26

27 The application of the reflex hammer **20** is illustrated in Fig. 8 where its
28 movement relative to a reflex site, such as the knee **50** of a human, is shown. In
29 use, two positions of the reflex hammer **20** as it is moved to an impact position are
30 illustrated (omitting the hand of the person applying the hammer for purposes of
31 illustration). In position **A** in Fig. 8, the reflex hammer **20** has begun its movement
32 towards the knee **50**. At position **B**, the reflex hammer has reached its point of
33 impact **53** with the knee, to elicit a patellar tendon reflex, wherein the body **24** of
34 reflex hammer strikes the patient. The reflex hammer **20** may be used in all ways
35 as a typical reflex hammer is used. For example, it may be used in the percussion of

1 a chest wall, or any other area of the body that may need to be percussed for
2 diagnostic purposes.

3

4 **Alternate Emb diments:**

5

6 Alternate embodiments are shown in Figs. 10 through 13, inclusive, which
7 differ in the shape of the body and the handle of the reflex hammer **20**.

8

9 For example, if the length of the stem **6** of a stethoscope were to be
10 increased (Fig. 9A) from the "standard" lengths commonly employed in the industry,
11 to form an elongated, or oversized (or extra-long) stem, thereby allowing a user to
12 hold the stem as a reflex hammer, the present invention could be modified to suit
13 such a stethoscope. For example, Fig. 10 shows a reflex hammer in the form of a
14 donut-shaped attachment element **65** mounted on the head of the stethoscope to
15 increase the surface area of the reflex striking force, in accordance with an
16 embodiment of the present invention. In this embodiment, the user grasps the stem
17 **6** to use the reflex hammer.

18

19 This attachment element **65** could be produced separately, by a manufacturer
20 or an after-market device manufacturer, and could be made from a plastic or a
21 rubber, or combinations thereof. This attachment element could be affixed to the
22 stethoscope head **3** in one piece shaped like an incomplete circle, or in multiple
23 pieces, or in symmetrical or asymmetrical shapes, where it could attach to the head
24 around the neck **10**, or around the bell **4** and/or diaphragm **5**. Other embodiments
25 anticipate increasing the striking area of the stethoscope head by either increasing
26 the plastic/rubber or electrometric surface area or adding additional material to the
27 stethoscope head. Instead of a donut-like configuration, this additional material
28 could comprise a ring which would affix around the head of the stethoscope, and if
29 made of an elastomeric or plastic material, provide shock absorbing properties as
30 well. This ring could be affixed to the head **3** in one piece shaped like an incomplete
31 circle, or in multiple pieces, or in symmetrical or asymmetrical shapes. It could
32 attach to the head either around the diaphragm **5**, bell aspect **4**, or around the neck
33 **10**.

34

35 Further adaptations include a locking mechanism **62** that prevents the stem
36 from rotating without first releasing the lock (Fig. 9B). The presence of a locking

1 mechanism would lock the stethoscope head **3** on its axis so that the head does not
2 shift or rotate upon striking, as when used in neurological or other diagnostic testing.
3 As shown in Fig. 9B, locking mechanism **62** is incorporated into the stem, where the
4 stem comprises a rotating member **63** and a receiving member **64**. Receiving
5 member contains an aperture **66** into which the lock **68** is inserted. Lock **68** is a tab
6 which is spring-like, and can be made from the same material as the stem, although
7 other suitable materials could be substituted therefor. By depressing tab **68** so that
8 it passes through aperture **66**, and grasping the rotating member **63**, the stem can
9 be rotated, allowing use of the bell **4** or diaphragm **5**. However, while the tool of the
10 present invention is being used for neurological testing, the stethoscope head **3** is
11 locked in position. A locking mechanism could also be affixed to the axis from
12 outside of the rotational mechanism.

13

14 Other embodiments of a locking mechanism could include mechanisms such
15 as depressing a spring-loaded button, tab, or ball (such as a ball bearing) through an
16 aperture; twist-lock mechanisms, similar to those used on photographic tripods; click
17 stop mechanisms; key lock mechanisms, or other locking mechanisms known to
18 those skilled in the art. Such a locking mechanism could be built into the
19 stethoscope before its initial sale, or can be designed to be retrofitted into existing
20 stethoscopes. Similarly, a stethoscope could be modified with a telescoping device
21 that would enable the elongation of the stem **6** to a distance similar to that of the
22 handle **22** of an embodiment of the reflex hammer of the present invention. The
23 distal aspect of the tubing **7** could also be made rigid by adding a stiffening
24 attachment to the stem **6**. This elongated stem or stiffened section would act as a
25 handle for the reflex hammer function of the stethoscope. Fig. 11 illustrates an
26 embodiment in which the distal aspect of the tubing **7** has been made rigid by
27 adding a stiffening attachment **70** to the stem **6**. Stiffening element **70** is an add-
28 on extension, or tube, made from a material such as a plastic or metal, and once
29 mounted on this region of tubing **7**, limits the flex of the distal end of the
30 stethoscope tubing **7**. This elongated stem or stiffened section acts as a handle for
31 the reflex hammer function of the stethoscope. As will be described further,
32 stiffening element **70** can fit over the tubing in a variety of ways such as: a "clam
33 shell" design thereby clipping over the tubing, but not compressing it. It could lock
34 in this position or could be easily removed. The design consists of a rigid tube with a
35 slit longitudinally allowing for the tubing to be compressed into the rigid tube and

1 then exist therein in an uncompressed fashion. This tube could extend until it
2 reached the median aspect of the head **3** or extend any distance including the
3 possible extension to attach or cover some aspect of the head. It could involve a
4 flange that would extend to the head and stabilize it to stop it from rotating on its
5 axis.

6

7 Fig. 12 illustrates the combination comprising both the donut-shaped
8 attachment element **65** and the add-on stem **70** attached to a stethoscope, to act as
9 a reflex hammer, in accordance with another embodiment of the present invention.

10

11 Fig. 13 shows another alternative embodiment **97** of the present invention,
12 but manufactured in a two-piece manner. The two members **90** and **93** are
13 symmetrical, and designed to interlock with each other to form reflex hammer **97**.
14 Each member **90** and **93** contains one or more fastening means, which could be a
15 hook and eye closure **95** and **96**, respectively. The fastener could also be a snap
16 **98** or other fastener **100**, known to those skilled in the art, such as, but not
17 intended to be limited to, a locking pin, button, nib, adhesive strips, hook and loop
18 fasteners or the like. Alternatively, the members could contain ridges or similar
19 means to enable them to be joined by means of a press-fit or snap-fit. The fasteners
20 could be permanently affixed to each other or be removable depending on
21 manufacturing method. The parts would snap, glue or fasten together in such a way
22 that they become one piece **97** and would be able to rotate freely around the
23 stethoscope hose. As can be seen in Fig. 5A, the location of the fasteners **100**
24 within the reflex hammer handle are spaced sufficiently far apart to act as a means
25 for retaining the stethoscope tubing **7** therein, and can also function as a guide for
26 attaching the reflex hammer of the present invention to a stethoscope.

27

28 Fig. 14 shows an asymmetrical version **102** of another alternative
29 embodiment. In this embodiment, the parts would snap, glue or fasten together in
30 such a way that the hose could be able to rotate freely if desired. The parts could
31 either be permanently affixed to each other or removable, depending on
32 manufacturing method. Additionally the head of the members **103**, **104** could be
33 asymmetrical, allowing for different striking surface areas **105**. The striking area
34 **105** could be molded in the similar plastic as the clamshell or in a different
35 durometer material either molded in or affixed secondarily in assembly. Additionally

1 the parts could snap together by means of fasteners **110**, such as a button, pin, nib,
2 press-fit or snap-fit, or other fastener as has been described previously.

3

4 In an embodiment of the present invention, the reflex hammer **20** is made of
5 a plastic material, but any suitable material could be employed, including natural or
6 synthetic rubbers, metals, polytetrafluoroethylene (TEFLON®, DuPont Corp.
7 Wilmington DE), nylon, other plastics, such as polyethylene, polycarbonate, polyvinyl
8 carbonate, or the like could be substituted therefor.

9

10 Therefore, although this invention has been described with a certain degree of
11 particularity, it is to be understood that the present disclosure has been made only
12 by way of illustration and that numerous changes in the details of construction and
13 arrangement of parts may be resorted to without departing from the spirit and scope
14 of the invention.